III. HYDRAULIC DESIGN CRITERIA AND FACILITY SIZING

A. Debris Yield

Sediment yield values were calculated at the concentration points for twelve selected watersheds using the USACOE method entitled "Los Angeles District Method for Prediction of Debris Yield." The method to be used to predict total debris yield, and the related parameters to be used in the calculations, were approved by the District. The results of the debris yield calculations are summarized in Table 3.

Seven of the drainage areas chosen for debris yield estimates include the six recommended new detention basin sites, and the existing Old Woman Springs debris basin site. The estimated debris yields were used in the conceptual sizing of the six new basins. The data were also used to estimate the debris bulking factor to be used in sizing debris carrying channels.

The largest adjusted unit debris yield, 45,697 cubic yards per square mile, was calculated for Piñon Creek. Assuming that the entire debris volume was transported in the peak 30 minutes of the storm volume, the increase in peak discharge would be approximately 685 cfs. This increase in flow rate due to debris flow results in a debris bulking factory of 1.39. The District's recommended bulking factor of 1.50 was used for sizing all debris carrying channels. Since the debris volumes generated by other drainage areas, on a cubic yard per square mile basis, will be less than Piñon Creek, the selection of a 1.5 debris factor to be applied to clear water flow depth, is considered appropriately conservative.

All debris yield calculations are included in Appendix D.

B. Hydraulic Design Criteria

1. General

The development of criteria for sizing both the non-detained and detained Master Plan facilities was based on the desire to use rock materials for channel stabilization rather than concrete. This approach is consistent with the Town's goal of preserving the current character of the desert community while assuring a safe, durable, and reliable flood control system.

2. Design Criteria

Criteria utilized to size the flood control system are summarized below:

a) Mannings "n" values

Type of Conveyance	"n" values
Managed Floodplain	0.045
Rock Lined Channel	0.035
Rock Revetted Side Slope Channel	0.026 - 0.030[1]
Soft bottom Channel [2]	0.025
Street Sections	0.018
Concrete Lined Channel	0.014
Reinforced Concrete Box	0.014
Reinforced Concrete Pipe	0.013

[1] n-value varies depending upon depth and bottom width of channel

[2] n-value assumes no slope revetment

b) Freeboard

Flow Condition	Distance from Water Surface to Top of Bank, feet
Unbulked Flows[1]	2.5 feet
Bulked Flows	2.5 [2]

[1] Regional systems downstream of detention basins assumed to convey clear water flow to points of confluence.

[2] Freeboard applied to clear water flow depth times 1.5 to account for debris bulking.

c) Discharges

Drainage Facility	Return Frequency, Years[3]
Regional Systems	100[1]
Secondary Systems	25[2]
Local Systems	25

[1] Q100 should exceed 750 cfs

[2] Q25 should exceed 300 cfs

[3] Where both unit hydrograph and rational method discharges were determined at a specific nodal point, unit hydrograph discharges were used. Where discharges are attenuated due to flood routing in a reach, the larger of the flow rates was used to size the drainage facility.

d) Rock Stability

Rock slope revetment and invert lining was sized to be stable without grouting for flow velocities up to 15 feet per second (fps). If velocities exceed 15 fps, grouting may be utilized in lieu of larger rock sizes.

e) Detention Basin Capacity

Detention basins were sized to manage 100-year (AMC III) inflows with debris yield in storage prior to the start of basin inflow. Spillways were sized to pass three times the 100-year peak inflow. Minimum freeboard on embankment crest is two feet.

C. Hydraulic Sizing of Conveyance Systems

1. Open Channels

Open channels were sized based on normal depth calculations and applying the required sediment bulking and freeboard criteria. Sizing calculations are included in Appendix D.

2. Underground Systems

Underground conduits were assumed to be essentially debris free (carrying only wash load suspended sediments). Underground pipe and box conduits were sized to flow full based on normal depth calculations. Sizing calculations are included in Appendix D.

The results of the hydraulic sizing calculations are summarized on Tables 4 and 5 for the non-detained and detained drainage scenarios, respectively.

D. Hydraulic Sizing of Detention Basins

Stage-storage-discharge relationships were computed based on conceptual layout plans prepared for each basin site. Inflow hydrographs based on AMC III watershed conditions were flood routed through each basin to calculate peak ponding levels and outflow discharges. Basin storage and outflow relationships were adjusted to improve peak reduction considering the anticipated acreage available for basin construction. As indicated in Section B.2.e above, debris volumes were assumed to be in storage during flood routing.

E. Preparation of Plan and Profile Drawings

Plan and profile drawings were prepared at a 1 inch = 1000 feet horizontal, and 1 inch = 40 feet vertical scales for both the non-detained and detained scenarios. Regional, secondary and local facilities are shown in plan. Only the regional and secondary facilities are profiled. Identifying facility numbers and conveyance types are also shown on the drawings. The plan and profile sheets for the non-detained facilities are included in Appendix E, sheets 1 through 32. The plan and profile sheets for the detained facilities, which represent the recommended MPD, are shown on Figures 5 through 36. The conceptual designs for the detention basins are shown on Figures 37 through 42.